CLAIMS

1. A method of fabricating an optical fibre laser, the method comprising the step of exposing an optical fibre to a transverse writing light beam to form a grating structure in a section of the optical fibre, the writing light beam being polarised in a direction not parallel to the axis of the section of the optical fibre so that the induced grating structure has a different grating strength for two orthogonal polarisation modes of the optical fibre, the grating structure comprising a discrete phase shift which is substantially identical for the two orthogonal polarisation modes.

2. A method according to claim 1, in which the writing light beam is polarised in a direction substantially perpendicular to the axis of the section of the optical fibre.

3. A method according to claim 1 or claim 2, in which the writing light beam is an ultraviolet beam.

4. A method according to claim 3, in which the ultraviolet beam has a wavelength of about 244 nanometres.

5. A method according to any one of claims 1 to 4, in which the optical fibre section is doped with at least one amplifying dopant.

6. A method according to claim 5, in which the optical fibre section is doped with at least one rare earth element.

7. A method according to claim 6, in which the optical fibre section is doped with erbium and ytterbium.

8. A method according to any one of claims 1 to 7, wherein the optical fibre laser is stressed to provide substantially single polarisation operation.

9. A method according to any one of claims 1 to 7, wherein the optical fibre laser is stressed to provide dual polarisation operation.

10. A method according to any one of claims 1 to 8, wherein the grating structure is written as a Moire phase shifted structure to provide lasing operation at two wavelengths having one polarisation.

11. A method according to any one of claims 1 to 8, wherein the grating structure is written as first and second overlaying DFB grating structures to provide lasing operation at two wavelengths having one polarisation.

12. An optical fibre laser comprising an optical fibre having a grating structure in a section of the optical fibre, wherein the grating structure has a different grating strength for two orthogonal polarisation modes of the optical fibre, the grating structure comprising a discrete phase shift which is substantially identical for the two orthogonal polarisation modes.

13. An optical fibre laser according to claim 12, in which the optical fibre section is doped with at least one amplifying dopant.

14. An optical fibre laser according to claim 13, in which the optical fibre section is doped with at least one rare earth element.

15. An optical fibre laser according to claim 14, in which the optical fibre section is doped with erbium and ytterbium.

16. An optical fibre laser according to any one of claims 12 to 15, wherein the optical fibre laser is configured to provide substantially single polarisation operation.

17. An optical fibre laser according to any one of claims 12 to 15, wherein the optical fibre laser is configured to provide dual polarisation operation.

18. An optical fibre laser according to any one of claims 12 to 15, wherein the optical fibre laser is configured to provide dual wavelength operation having one polarisation.

19. An optical fibre laser according to claim 18, wherein the grating structure is a Moire phase shifted structure having one polarisation.

20. An optical fibre laser according to claim 18, wherein the grating structure comprises first and second overlaying DFB grating structures.

21. An optical phase conjugator comprising:

one or more in-line optical fibre lasers according to any one of claims 12 to 20 for generating two substantially orthogonally polarised pump light beams; and

a non-linear mixing waveguide for receiving and mixing the pump beams with an input signal beam.

22. A phase conjugator according to claim 21, in which the non-linear mixing waveguide is selected from the group consisting of: a dispersion-shifted optical fibre; a chalcogenide optical fibre; and a semiconductor optical amplifier.

23. A phase conjugator according to claim 21 or claim 22, in which the two pump beams have wavelengths displaced to either side of the wavelength of the signal beam.

24. A phase conjugator according to any one of claims 21 to 23, in which the one or more in-line optical fibre lasers comprise:

a first single polarisation optical fibre laser according to claim 16;

a polarisation controller for varying the polarisation of a light beam generated by the first single polarisation optical fibre laser; and

a second single polarisation optical fibre laser according to claim 16 connected in series with the first single polarisation optical fibre laser and the polarisation controller.

25. A phase conjugator according to any one of claims 21 to 23, in which the one or more in-line optical fibre lasers comprise:

a dual polarisation optical fibre laser according to claim 17.

26. A laser source comprising:

a single polarisation, dual wavelength laser according to claim 18 having two output wavelengths;

means for detecting and monitoring a beat frequency between the two output wavelengths of the laser; and

a feedback circuit operable to control the two output wavelengths of the laser to keep the detected beat frequency substantially constant.

Add B2